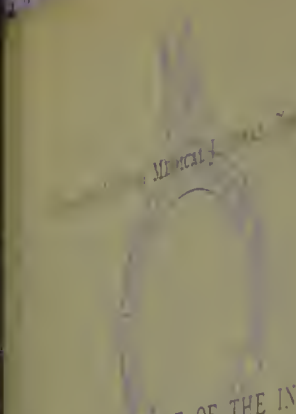


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OF THE THIGH WAS SUCCESSFULLY PERFORMED
WITH REMARKS.

By WALTER RIVINGTON, M.S. Lond., F.R.C.S. E.
Surgeon to the London Hospital.

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being brought under the notice of the British Medical Association.
The particulars of the case are these.

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thigh must have come violently into contact with the edge of
the patient was admitted into the London Hospital on
May 8th, 1874, at 7.30 P.M., shortly after the accident. There
was no sign of severe contusion; but, on examination, Mr.
Rivington, did not detect any abnormal mobility
or evidence of a dislocation. There was not much
tenderness of the joint, and the patient could bear a
moderate amount of pain. The right knee was bruised. The
greatly increased, and the patient complained of
pain below the middle of the leg. On examination, the
circumference of the left limb, three inches above the
point of injury, was found to be seventeen inches, while the
circumference of the right limb, at the same point, was
only sixteen inches. At 11 A.M., the next morning, the
Great swelling existed above the point of injury.

A CASE OF RUPTURE OF THE INTERNAL AND MIDDLE COATS OF THE POPLITEAL ARTERY, AND COMPLETE RUPTURE OF THE POPLITEAL VEIN, FOR WHICH PRIMARY AMPUTATION OF THE THIGH WAS SUCCESSFULLY PERFORMED: WITH REMARKS.

By WALTER RIVINGTON, M.S.Lond., F.R.C.S.Eng.,
Surgeon to the London Hospital.

THE comparative rarity of partial rupture of the popliteal artery will, I hope, impart sufficient interest to the following case to justify me in bringing it under the notice of the British Medical Association. The particulars of the case are these.

James Collins, aged 19, a muscular well built young man, of fair complexion, was sitting on the front seat of an omnibus; the retiring angles of his knees were in close correspondence with the projecting edge of the seat. A runaway horse and cart came rushing up and dashed into the omnibus. The cart was a railway cart with a high curved cover, and one corner of this cover struck against the patient's left knee and drove it backwards, so that the recess of the popliteal space must have come violently into contact with the edge of the seat. The patient was admitted into the London Hospital on Friday, May 8th, 1874, at 7.30 P.M., shortly after the accident. The left knee showed signs of severe contusion; but, on examination, Mr. Bowkett, the house-surgeon, did not detect any abnormal mobility. There was no evidence of a dislocation. There was not much effusion into the cavity of the joint, and the patient could bend it with only a slight amount of pain. The right knee was bruised. By 9 P.M., the swelling had greatly increased, and the patient complained of partial loss of sensation below the middle of the leg. On measurement, the circumference of the left limb, three inches above the upper border of the patella, was found to be seventeen inches, whilst that of the other side was only thirteen inches. At 11 A.M., the next morning, he was seen by myself. Great swelling existed above and below the left knee for

some distance. The knee-joint was distended. The limb was perceptibly cooler than its fellow. The posterior tibial artery at the ankle yielded the faintest possible thrill, so faint, indeed, that most of those who examined the case could not perceive it. On auscultating the limb over the course of the popliteal artery, I detected a peculiar low clicking sound, much resembling the ticking of a watch under a pillow. The diagnosis formed was probable rupture of the popliteal artery and vein, either partial or complete. There was too much swelling to determine the existence of any accompanying fracture. It was decided to send for the friends, and to recommend amputation in the course of the afternoon. At 3.30 P.M., the patient was seen also by my colleague Mr. Hutchinson, who concurred in the diagnosis, and strongly advised the patient, who seemed at first unwilling to consent, to submit to the loss of his limb. By this time, the swelling had invaded the thigh and the leg farther, both upwards and downwards, and the foot was assuming a mottled aspect. The consent of the patient and his friends having been obtained, I amputated the thigh at the lower third, adopting a modification of Teale's method, which I have practised for some years. The anterior flap was rounded at the angles and cut rather shorter, whilst the posterior flap was cut rather longer, than the corresponding flaps in Teale's amputation. The greater portion of the anterior flap consisted of skin and fascia only. On completing the removal of the limb, we found that the areolar tissue underneath the skin of the posterior flap was infiltrated with dark blood for some distance, and, as it seemed possible that the part had been bruised and might slough, it was thought advisable, as a precautionary measure, to take away an inch more of the femur, so as to obviate all chance of subsequent protrusion. Accordingly, the periosteum was stripped up for an inch and the bone sawn off. Subsequently, however, not the slightest sloughing action took place, the blood previously effused undergoing absorption. Four or five ligatures were required; the flaps were brought together with wire sutures, simple dressing was applied, and the patient was sent to bed.

The progress of the case was scarcely interrupted by any unfavourable symptom. Both the temperature and pulse had a high range for a few days, as might have been expected, the former reaching 102 deg. and 103 deg., the latter 120; but, within a week, the temperature was at 99 deg. and the pulse 100. By the 18th, the flaps had united by first intention, except at the lowest part; and, by the 28th, the ecchymosed portions had regained the aspect of health. In the middle of June, the patient was going about on crutches, and, in another month,

he was sent to the seaside, his stump being entirely healed. On his return, he was ordered an artificial leg, the stump bearing pressure well.

Examination of the limb showed blood extensively infiltrated beneath the skin and in the planes of areolar tissue. The popliteal space was filled with dark blood, and dark blood flowed from the knee-joint through an opening in the posterior ligament, which had been slightly torn. The plantaris muscle was torn from its attachment to the femur. At the lower limit of the popliteal space, the popliteal vein was found completely severed, whilst the wall of the artery adjacent to the ruptured vein was evidently thinned. On laying open the artery, the inner and middle coats were seen to be separated from the external for half an inch and turned downwards towards the foot. The impulse of the current of blood against the loose flap had doubtless caused the clicking sound heard with the stethoscope. A further dissection of the parts was made by Mr. Clippingdale. He found that the internal popliteal and posterior tibial nerves were surrounded by dark coagulated blood, which had compressed them and reached nearly to the ankle joint. On opening the knee-joint on the anterior aspect, he observed that the ligamentum mucosum had been torn through, and that the anterior crucial ligament was injured. A small quantity of dark blood still remained in the cavity of the joint. The external semilunar cartilage was partially displaced.

The external condyle was nearly separated from the rest of the femur by a deep fissure extending along its internal and anterior surfaces, whilst a small triangular piece of bone was loose and projected into the joint. A fissure, commencing behind the external tuberosity of the tibia, ran forwards across the articular surface down the front of the head to the upper end of the tubercle, where it bifurcated the inner branch, terminating on the inner side of the tubercle, whilst the outer branch ran down to the outer side of the tubercle, and, after dividing to enclose a triangular piece of bone, continued its course down the inner surface of the tibia for a distance of four inches. The fibula and the patella were uninjured. The fractures of the femur and tibia were effected by the corner of the railway-van, and at the same time as the rupture of the vessels; but they had no causative connection with the vascular lesions; they were simply a comparatively unimportant accompaniment of the ruptures.

REMARKS.—Rupture of the popliteal artery is, I believe, generally associated with displacement of the tibia at the knee-joint, and involves usually all the coats of the vessel. Such cases have hitherto of

necessity required amputation ; and the only question which arises in reference to the operation is, whether it is better to perform it at once as soon as the lesion is diagnosed, or to wait until gangrene has commenced. I think that the opinion of most surgeons would be strongly in favour of early amputation, whereby the patient would be saved from all risk of his blood becoming contaminated by the products of the decomposition of his tissues. More especially would this consideration weigh with a surgeon not yet converted to the antiseptic system, and attached to a metropolitan hospital where pyæmia is prevalent and mars the success of operations, however well conceived and executed they may be. In a primary amputation, the surgeon obtains healthy or nearly healthy flaps ; in a secondary amputation, after gangrene has commenced and is spreading, he may have to cut through tissues infiltrated with inflammatory exudation.

In reference, however, to the actual results of cases, I am not in possession of sufficient data to determine the point. That secondary amputation may be attended with a very satisfactory result is shown by several reported cases. A case is related by Mr. Jackman in the fourth volume of the *St. Bartholomew's Hospital Reports*. The patient was a healthy farmer fifty-six years of age. He was superintending his men, who were removing some large stumps of old trees. The men had placed a chain round one tree, and, while the patient was standing with his back to them, the horses employed made a sudden plunge forward, which tightened the chain with a jerk and caused it to catch him just under the knee and throw him down with great force. Gangrene set in ten days after the accident, and amputation was performed above the knee four days later. The popliteal artery was torn across, but its ends were surrounded by a tumour about the size of a pigeon's egg, which had the appearance of a false aneurism. Both ends of the artery were closed. The state of the popliteal vein is not described.

Again, in the fifth volume of the *St. Bartholomew's Hospital Reports*, Mr. George Lowe has recorded two cases of complete dislocation of the tibia forwards at the knee joint, with rupture of the popliteal vessels. The first patient was a fine healthy collier thirty-six years of age. Amputation was performed in the upper third of the thigh six days after the accident, when gangrene supervened. Both the popliteal artery and vein were found completely torn across. The patient made a good recovery. In the second case, amputation was performed in the upper third of the thigh on the third day after the accident. The popliteal vessels were completely torn across. The patient was

a comparatively feeble man thirty-two years of age, but he recovered well. The success of these three cases may be partly ascribed to the fact that the operations were performed in the country, and the success of two out of the three may be also ascribed to the healthy condition of the patients. It is worthy of note, however, that, in Mr. Lowe's cases, the accession of gangrene compelled amputation in the upper third of the thigh, whereas primary amputation could be performed, I should think, in most cases in the lower third. This difference tells considerably in favour of amputation before the occurrence of gangrene.

As a general rule, I think it may be stated that, in cases caused by contusion or dislocation, the popliteal artery can scarcely be torn across, either partially or completely, without corresponding injury to the popliteal vein. This complication must necessarily exhanche the gravity of the case. Apart from additional interference with the circulation caused by interruption to the current of blood, the accompanying extravasation would be increased, and the probability of a circumscribed false aneurism forming and limiting the effusion would be considerably lessened.

In the case which I have related, the lower part of the thigh, the popliteal space, and the upper part of the leg were infiltrated with blood, and the knee-joint was distended, the foot was cold and becoming mottled, and yet the effused blood was derived wholly from the ruptured popliteal vein.

Rupture of the inner coats of a large artery is a lesion probably of unfrequent occurrence, and, although I have not had time to search in the various medical periodicals for cases, I believe that comparatively few have been placed on record. It is a lesion, however, which might readily be overlooked or mistaken for embolism. Where, for instance, the internal and middle coats of an artery are turned down and block up the artery, pulsation will be traceable as far as the obstruction, whilst the distal portion of the artery will be pulseless, at least as far as the first large branch, and the limb below, especially if the lower extremity be the seat of the lesion, will be colder than its fellow, just as in the case of an embolic block in the artery. Mr. Pick states that there is a specimen of partial rupture of the left axillary artery in the St. George's Hospital Museum, showing the two inner coats turned down, and involving the vessel in the third part of its course. It was taken from a man who died of an injury to the head. During life, pulsation could be traced to the lower part of the axilla. This is evidently the same case as that related by Mr. Holmes in his text-book of the *Principles and Practice of Surgery*. Mr.

Holmes states that "the symptoms of the injury were so clearly marked that it was easy to diagnose both the nature and the precise seat of the lesion". The superficial situation of the artery at the injured spot rendered it obvious that the torn coats had been pushed into the tube of the vessel by the blood, so as to close it, and the condition of the artery was exactly verified by *post mortem* examination. A second specimen in St. George's Hospital Museum shows a laceration of the internal and middle coats of the femoral artery. A third case has been related by Mr. Pick in the seventeenth volume of the *Transactions* of the Pathological Society. The patient, twenty-five years of age, received a violent blow from a crowbar on the front of the right thigh, the effect of which seems to have been to cause a partial rupture of the popliteal artery. He experienced a sudden and intense pain at the back of the knee-joint, lasting some minutes and causing him to feel very faint. The pain passed off, and he resumed his work as a navigator, continuing at it for a week, in spite of pain and swelling of the limb. After walking several miles on the sixth day after the injury, he experienced pain so severe, and so much swelling, that he had to be conveyed home and confined to bed. Five weeks later, he was admitted into St. George's Hospital in a state of collapse and with enormous swelling of the left leg. Amputation of the thigh was performed. The patient rallied, but died of pyæmia on the nineteenth day after operation. The popliteal artery was found torn across, but not completely, a strip of the anterior wall still uniting the two ends. The vein was not injured, but its walls were thickened.

Partial rupture of a large artery may lay the foundation for an aneurism, either circumscribed or diffused. Mr. Pick has related, in the sixth volume of the *St. George's Hospital Reports*, a case of the kind. A policeman, thirty-one years of age, strained his left thigh. Five months afterwards, he was obliged to give up duty and go into the hospital, a pulsating swelling having appeared on the inner side of the thigh. Digital compression was tried, but proved inefficacious, and the swelling of the limb increased so much, that gangrene supervened and necessitated amputation at the hip-joint, from which the patient succumbed. The aneurismal sac was situated at the junction of the femoral and popliteal arteries, and seemed to be largely formed of the external coat of the vessel. I have also placed on record a case of traumatic axillary aneurism, in which it was an open question whether a complete or partial rupture of a segment of the arterial circumference was the primary lesion. The patient was seventy years of

age. Four days before admission, he had fallen out of a cart and displaced his left humerus at the shoulder-joint. Two days after the accident, the dislocation was reduced by a practitioner by extension with the foot in the axilla. On admission, there was considerable, but not excessive, swelling of the shoulder-joint, without pulsation in the swelling. The pulse beat naturally at the wrist. A small hard lump, about the size of a pigeon's egg, could be felt at the base of the axilla, over the site of the axillary vein, and not receiving impulse from the axillary artery. Under these circumstances, more fully detailed elsewhere, I diagnosed an effusion of blood into the axilla and shoulder-joint, stating my belief that the blood came, not from a ruptured axillary artery, but either from smaller vessels or from the vein. Strict rest, with bandages only, was enjoined to promote absorption. A month later, when the patient was not under my charge, aneurismal symptoms appeared, pulsation and *bruit* being both perceptible, and the pulse at the wrist became feebler. Various suggestions as to treatment were made, the most prominent being ligature of the subclavian artery; but the patient declined operative interference. Ultimately, ulceration of the skin took place, hæmorrhage occurred, the axilla was laid open, and the injured vessel was secured at the seat of lesion. A transverse aperture was found in the third part of the course of the axillary artery, occupying about a third of the circumference of the artery. In view of the uncertainty as to the source of the effusion of blood in this case, and the advanced age of the patient, which rendered any operative interference at any stage of his case wellnigh hopeless, there can be no doubt as to the propriety of the treatment recommended in the first instance by myself. I am pleased to have the opportunity of quoting a published opinion of my colleague Mr. Maunder in reference to this subject. In his Lettsomian Lectures (*vide Lancet*, February 27th, 1875, page 295, Case 24), Mr. Maunder speaks strongly against the application of a ligature to the subclavian artery, and states that either of the two other means of treatment at our disposal, amputation at the shoulder-joint and laying open the axilla, would in all probability have terminated fatally. This opinion effectually disposes of the suggestions made at the time that ligature of the subclavian artery ought to have been performed, and that it would have been better to operate at an early period in the history of the case.

A point of considerable interest arising out of this case is the possibility of locating the seat of injury in some of the cases of ruptured axillary artery. It is evident that, if the third part of the artery be

involved, and if this can be rendered probable, the severe procedure of laying open the whole anterior wall of the axilla might be avoided. A careful exposure of the third part of the artery would then be sufficient, combined with a simultaneous removal of the clots in the axilla. The introduction of the finger would probably enable the surgeon to trace the vessel and find out where pulsation ceased or became less marked even in a case which he had not previously seen. If, however, the case had come under his observation early, and there existed, as in my own case, a small hard circumscribed lump over the third part of the course of the vessel, the diagnosis would be rendered more probable. At all events, a more prolonged search for the seat of injury should be made whenever such a course is practicable, without danger of serious hæmorrhage continuing during the exploration.

Next, I would strongly recommend the application of the stethoscope over the site of an artery which there is any reason to think is ruptured either partially or completely. There is good reason to believe that, by means of auscultation, partial and complete ruptures may be diagnosed in some cases shortly after the injury, and when pulsation cannot be perceived. Mr. Holmes states that he has never seen any case where pulsation was present in the extravasated blood in connection with a complete subcutaneous laceration of an artery; but he says that, in some cases, a *bruit* can be heard (*Surgery: its Principles and Practice*, page 78).

Lastly, in these days of antiseptic surgery, when knee-joints can be laid open and fingered with impunity, when the surgeon is freed from all anxiety as to the results of operations, when exposed blood-clots cease to break down and decompose, but become organised in the open wound under the charm of carbolic acid and the antiseptic dressing, it may fairly be asked whether, in such cases as that which I have related, amputation should not be set aside until the wounded vessels have been sought for and tied in the popliteal space. Some of the extravasated blood could be removed by the operator and the rest be allowed to become either organised or absorbed; and, if the knee-joint had been opened by the accident, the triumph of antiseptic surgery would be all the greater. The only possible question would be, whether the circulation in the member could be carried on sufficiently to prevent the occurrence of gangrene. If this question should be capable of receiving an affirmative reply, no excuse would be left for the mutilation hitherto regarded by septic surgery as indispensable to save the life of the patient. .
